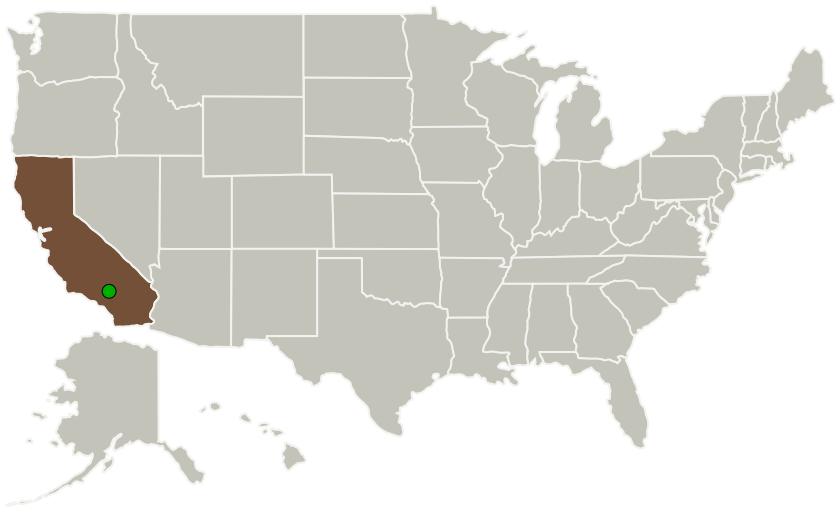
ePHM System Development, Hardware-in-the-Loop Testing, Fault Tree, and FMECA Applied to and Integrated on NASA Hybrid Electric Testbeds, Phase II

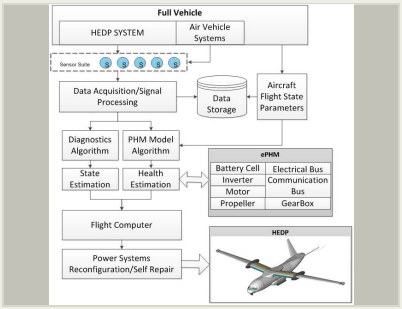
Completed Technology Project (2014 - 2019)

Project Introduction

Hybrid-Electric distributed propulsion (HEDP) is becoming widely accepted and new tools will be required for future development with validation and demonstrations during ground and eventually flight testing. Intelligent health management will be paramount to any future ground and flight testing activities planned by the industry on HEDP systems. To support this, an intelligent prognostics and health management (ePHM) system will be designed and executed for the HEDP system on the NASA Dryden Hybrid Electric Integrated System Teststand (HEIST) (AirVolt optional), which will be developed as part of a parallel Phase III SBIR by ESAero, the proposer here. Most developments in PHM surround air vehicle subsystems and avionics, specifically on the electronic board level, and many of these are integrated after the systems are designed. These developments have or are establishing the ability to monitor the degradation of a subsystem in real-time, making it conceivable that actionable information can be fed to a Integrated Autonomous Controller for self-repair decisions, leveraging the Propulsion Airframe Integration benefits. Reliability can be calculated and maintenance can be planned ahead of time rather than at the point of failure, significantly increasing safety. General Atomics, Electromagnetic Systems Group (GA) will continue to play a vital role.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Empirical Systems Aerospace, Inc.(ESAero)	Lead Organization	Industry	Pismo Beach, California
Armstrong Flight Research Center(AFRC)	Supporting Organization	NASA Center	Edwards, California

Primary U.S. Work Locations
California

Project Transitions

April 2014: Project Start

September 2019: Closed out

Closeout Summary: ePHM System Development, Hardware-in-the-Loop Testing, Fault Tree, and FMECA Applied to and Integrated on NASA Hybrid Electric Testbeds, Phase II Project Image

Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/137484)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Empirical Systems Aerospace, Inc. (ESAero)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Benjamin T Schiltgen

ePHM System Development, Hardware-in-the-Loop Testing, Fault Tree, and FMECA Applied to and Integrated on NASA Hybrid Electric Testbeds, Phase II

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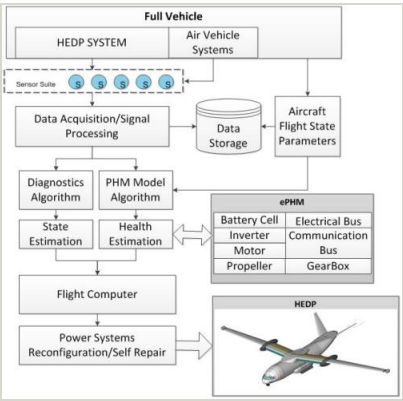
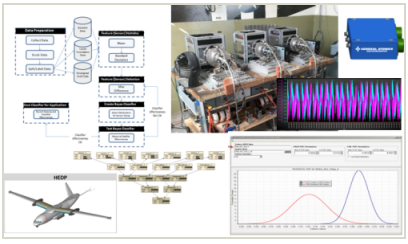
Images



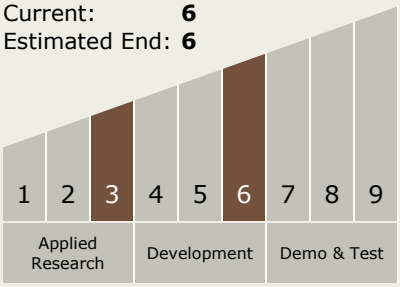
Briefing Chart Image
ePHM System Development, Hardware-in-the-Loop Testing, Fault Tree, and FMECA Applied to and Integrated on NASA Hybrid Electric Testbeds, Phase II *(https://techport.nasa.gov/image/136143)*



Final Summary Chart Image
ePHM System Development, Hardware-in-the-Loop Testing, Fault Tree, and FMECA Applied to and Integrated on NASA Hybrid Electric Testbeds, Phase II Project Image *(https://techport.nasa.gov/image/135582)*

Technology Maturity (TRL)

Start: **3**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.3 In-Situ Instruments and Sensors
    - TX08.3.4 Environment Sensors

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System